flooding from storm surges presents problems apart from the actual surge on the coast. The surge on inland waterways, as occurred on the Mississippi River, is also different in time and extent from the coastal surge.

In low coastal areas, such as the entire Louisiana coast, the surge is disposed of mainly by the sea water spreading over the lowlands, sometimes as far inland as 50 mi. The invasion of the surge water into the marshes creates and expands open bodies of water. The waves, generated by the wind over these bodies, help to transport greater amounts of water inland. The return of this water to the sea is a slow complicated process.

The tilting of water in inland lakes, such as occurred on Lake Pontchartrain, must be taken into consideration along with the surge to determine flooding possibilities.

As more industries and people continue to move into coastal areas subject to flooding, the determination of the extent of inland flooding becomes increasingly important for the protection of life and property. It is also becoming more difficult to determine the extent of the flooding. The continual construction or changing of levees, canals, navigable waterways, drainage, protective barriers, and other factors, contribute to the complexity of the inland inundation problem. Further complications arise by the changes which occur in the maze of levees. Natural changes, erosion and subsidence take their toll; also pilfering of the fill or actual cutting of the levees weakens the systems.

The loss of life, 57, in southern Louisiana, in hurricane Betsy occurred mainly from the inland flooding rather than from the actual surge on the immediate coast. A large part of the billion dollar loss was a result of inundation well away from the coastline. Except for the mass evacuation of 300,000 persons from the low coastal area, the loss of life in Betsy would have been appalling. Even when the storm surge on the coast can be adequately forecast, the problems of forecasting the extent of inland flooding must be resolved by extensive study and knowledge of the contributing factors for the area involved. Only when the extent of the flooding behind protective barriers for certain areas is reasonably anticipated can a major catastrophe be averted in some future storm.

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CORRECTION NOTICE

No. 1, January 1968, front cover, Contents, pp. 39–46: latter part of title of paper by Maunder should read "—A New Zealand Example."

PICTURE OF THE MONTH

An Example of the "Fujiwhara Effect" in the West Pacific Ocean

GILBERT JAGER

Applications Group, National Environmental Satellite Center, ESSA, Washington, D.C.

The "Fujiwhara Effect" is the name meteorologists use to describe the most spectacular of interactions between vortex pairs, that of tropical storms. The name comes from S. Fujiwhara whose studies on this phenomenon were published several decades ago (e.g. [1]). The interaction of vortex pairs is quite complex. Vortices may either attract or repel one another. Rotation will take place about a center of gravity (c.f. [2]) located on a straight line or great circle connecting them. The specific location of this center of gravity will be determined by the relative mass and intensity of the vortices. Interaction with nearby systems will also affect the motions of the vortex pair especially if the mass of the nearby system or systems is greater than that of either of the vortices in the pair.

From September 9 to 12, 1967, the ESSA 3 and ESSA 5 weather satellites photographed a splendid example of the "Fujiwhara Effect." Figures 1 through 4 show tropical vortices Ruth and Thelma for a 4-day period as these two storms approached typhoon Opal from the east. The latter storm is visible in figures 3 and 4. Figure 5 shows the tracks of the three storms for the period of the pictures. The positions indicated on the track chart are for the time of the satellite picture. The wind speeds shown at each storm position in figure 5 were obtained from the storm advisories. The interaction between Thelma and Ruth is most obvious between the 9th and 10th as Ruth is deflected southward from her previously westward path.

Although the vortex that became Tropical Storm Thelma appeared to be larger than Tropical Storm Ruth on the 9th, Ruth showed better organization and had higher winds. Throughout the period Ruth grew steadily, becoming a typhoon at 0600 GMT on the 10th and attaining 100-kt. winds on the 12th. Thelma was named at 0000 GMT on the 10th with winds of 35 kt. The wind

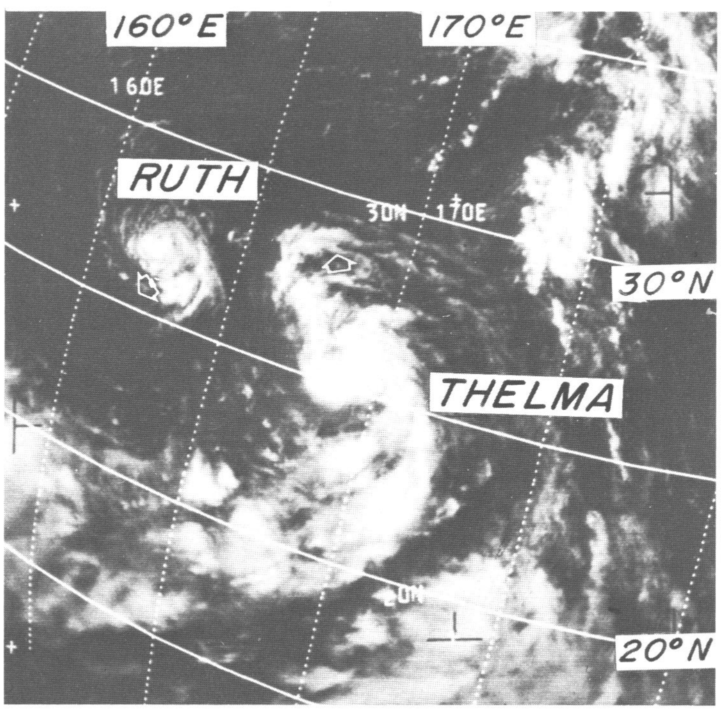

FIGURE 1.—ESSA 3 photograph. 0123 GMT, Sept. 9, 1967. Arrows indicate direction of storm movement at time of picture.

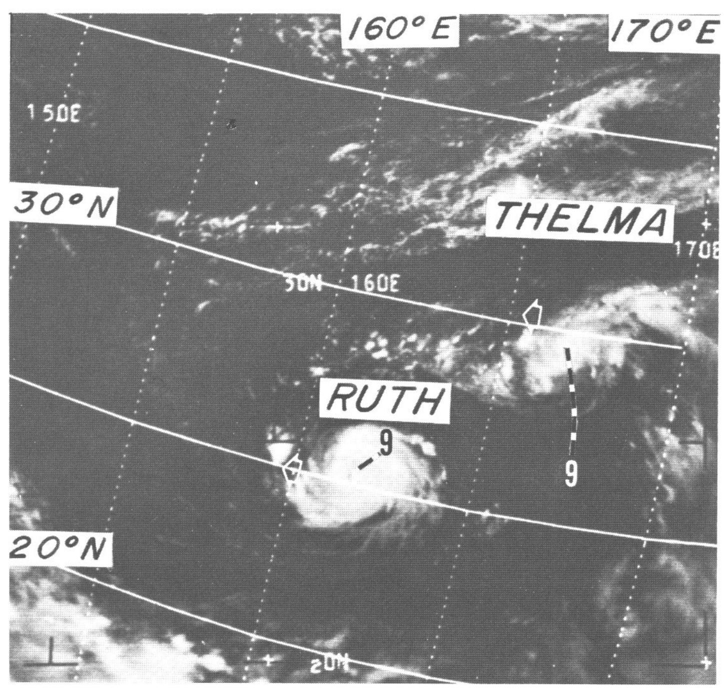

FIGURE 2.—ESSA 3 photograph. 0214 GMT, Sept. 10, 1967. Dashed lines show tracks for previous 24 hr. Twenty-four-hr. previous position indicated by number corresponding to the date.

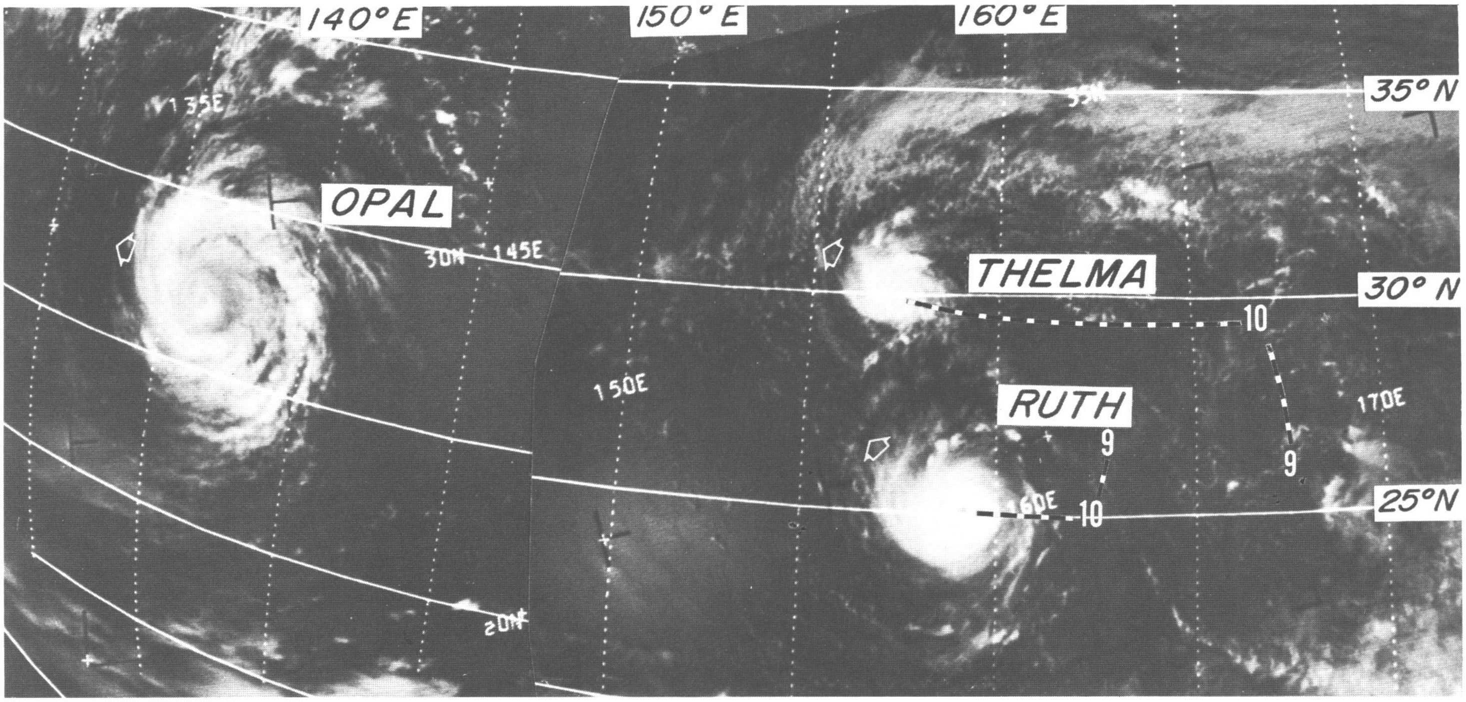

FIGURE 3.—ESSA 3–ESSA 5 composite photograph. 0304 and 0424 GMT, Sept. 11, 1967.

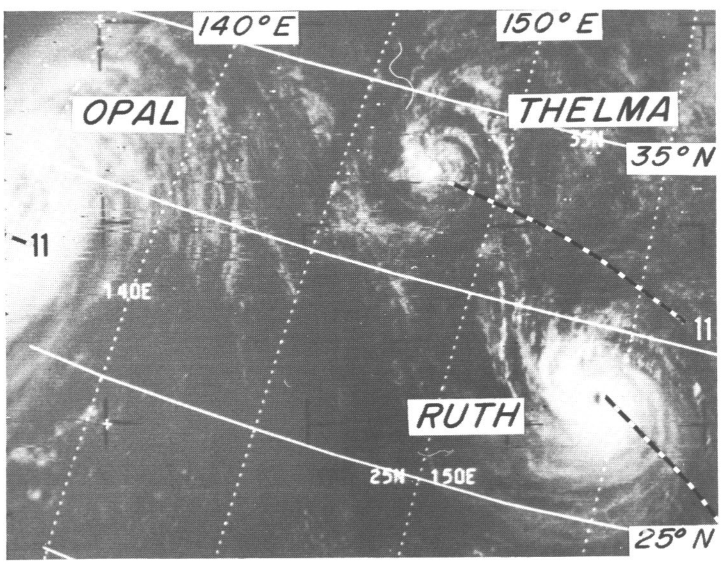

FIGURE 4.—ESSA 5 photograph. 0501 GMT, Sept. 12, 1967.

speeds of Thelma remained about the same throughout the period until late on the 12th, after which the storm decreased in intensity. Typhoon Opal maintained a nearly constant intensity with winds near 80 kt. reported on all 4 days. The low level winds of Ruth reached the same intensity as those of Opal on the 11th, and exceeded them by 20 kt. on the 12th as the smaller storm became more highly organized than the larger storm.

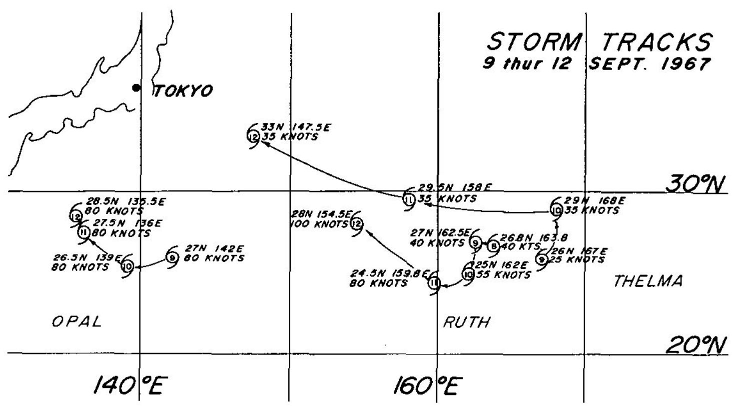

FIGURE 5.—Track chart. Number in center of each position symbol refers to the date.

While the interactions between vortex pairs in the atmosphere are not uncommon, the opportunity for observing this on a large scale in the Tropics is relatively rare. This series of satellite photographs shows the best example of the "Fujiwhara Effect" in the Tropics that has been observed to date.

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